Curriculum vitae of

DAVID S. TOURETZKY

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Education

B.A. 1978, cum laude, Rutgers University (Computer Science); M.S. 1979, Carnegie Mellon University (Computer Science); Ph.D. 1984, Carnegie Mellon University (Computer Science).

Honors and Awards

National Merit Scholar, 1976-78; Henry Rutgers Scholar (Mathematics) with Highest Distinction, 1978; Phi Beta Kappa and Sigma Xi, 1978; Fannie and John Hertz Foundation Fellow, 1978-83

Employment

July, 1991 to present: Carnegie Mellon University. Senior Research; Scientist in the Computer Science Department. January 1995 to present: 50% appointment in the Center for the Neural Basis of Cognition. December, 1996 to present: courtesy faculty appointment in the Robotics Institute. Current research interests: computational neuroscience; rodent navigation; animal learning.

July, 1987 through June, 1991: Carnegie Mellon University. Research Scientist in the School of Computer Science.

May 1984 through June, 1987: Carnegie Mellon University. Research Associate in the Computer Science Department.

September 1978 through April, 1984: Carnegie Mellon University. Graduate research assistant working with Scott Fahlman on the NETL parallel knowledge representation system, and with Jon Doyle on the formalization of inheritance

systems.

<u>July 1973</u> through June 1976: New Jersey Educational Computer Network (formerly Educational Information Services, Inc.) Research intern and programmer.

Personal

Born June 3, 1959. Single. US Citizen. Commercial pilot; certified flight instructor.

Tutorials and Invited Addresses

Third National Conference on Artificial Intelligence, Austin, Texas, August, 1984. A Tutorial on Lisp Programming."

Fifth National Conference on Artificial Intelligence, Philadelphia, August, 1986. Tutorial on Advanced Common Lisp Programming."

Sixth National Conference on Artificial Intelligence, Seattle, WA, July , 1987. Tutorial on Advanced Common Lisp Programming." (Presented in collaboration with Dr. Richard P. Gabriel of Lucid, Inc..)

Ninth National Conference on Artificial Intelligence, Boston, MA, July 1990. Applying Neural Network Technologies." (Tutorial presented in collaboration with Dr. Yann LeCun of AT&T Bell Labs.)

Tenth National Conference on Artificial Intelligence, Anaheim, CA, July ,1991. Applying Neural Network Technologies." (Tutorial presented in collaboration with Professor Geoffrey Hinton, University of Toronto.)

Tenth National Conference on Artificial Intelligence, Anaheim, CA, July, 1991. Invited address: Connectionism and Symbol Processing."

Twelfth International Joint Conference on Artificial Intelligence, Sydney, Australia, August, 1991. Neural Networks for Real-World Problems." (Tutorial presented in collaboration with Mr. Dean Pomerleau, Carnegie Mellon.)

VIII Conferencia Nacional de Informatica y Telecomunicaciones de Venezuela (INFORVEN), Caracas, Venezuela, September 1991. Tutorial: Neural Networks for Real-World Problems." Invited talks: Neural Networks and Cognitive Science" and Neural Networks for Sensing and Control."

Fifteenth Annual Conference of the Cognitive Science Society, Boulder, Colorado, June, 1993. Symposium on Grounding, Situatedness, and Meaning. (Title of invited presentation: The Hearts of Symbols: Why Symbol Grounding Is Irrelevant".)

Second Swedish Conference on Connectionism. March, 1995. University of Skovde, Sweden. Invited talk: Landmark Arrays and the Hippocampal Cognitive Map."

Fourth International Conference on Simulation of Adaptive Behavior (SAB96). Falmouth, MA. September, 1996. Invited talk: Representations of Space in the Rodent Brain."

Recent Seminars and Colloquia

Penn State Erie, The Behrend College, November 1997. Debate with John Frohnmayer, The First Amendment and the Internet." Michigan State University, Cognitive Science Colloquium. Skinnerbots:

Trainable Robots as Theories of Animal Cognition." December, 1998. Georgia Institute of Technology, Cognitive Science Colloquium. Incremental Learning in Animals and Robots." January, 1999. University of Chicago, Computational Neuroscience Seminar. Attractor Models of the Rodent Head Direction System." April, 1999.

SUNY Health Science Center at Brooklyn, NY. Constructing the Cognitive Map: Attractor Models of the Rodent Hippocampus." April, 2000.

Publications

Books

Touretzky, D. S. (1984) Lisp: A Gentle Introduction to Symbolic Computation. New York: Harper & Row, Publishers, Inc.

Touretzky, D. S. (1986) The Mathematics of Inheritance Systems. London: Pitman Publishing, Ltd. Distributed in the United States by Morgan Kaufmann Publishers, Inc., San Mateo, CA.

Touretzky, D. S. (1990) Common Lisp: A Gentle Introduction to Symbolic computation. The Benjamin/Cummings Publishing Company. Major revision and expansion of previous Lisp text.

Edited Collections

Touretzky, D., Hinton, G., and Sejnowski, T. (eds.) (1988) Proceedings of the 1988 Connectionist Models Summer School. San Mateo, CA: Morgan Kaufmann.

Touretzky, D. S. (ed.) (1989) Advances in Neural Information Processing Systems 1.

San Mateo, CA: Morgan Kaufmann.

Touretzky, D. S. (ed.) (1990) Advances in Neural Information Processing Systems 2. San Mateo, CA: Morgan Kaufmann.

Touretzky, D. S., Elman, J. L., Sejnowski, T. J., and Hinton, G. E. (eds.) (1990) Proceedings of the 1990 Connectionist Models Summer School. San Mateo, CA: Morgan Kaufmann.

Lippmann, R. P., Moody, J., and Touretzky, D. S. (eds.) (1991) Advances in Neural Information Processing Systems 3. San Mateo, CA: Morgan Kaufmann. Touretzky, D. S. (ed.) (1991) Connectionist Approaches to Language Learning.

Reprint of a special issue of Machine Learning for which I was guest editor. Boston, MA: Kluwer.

Mozer, M. C., Smolensky, P., Touretzky, D. S., Elman, J. L., and Weigend, A. S. (eds.) (1994) Proceedings of the 1993 Connectionist Models Summer School. Hillsdale, NJ: Lawrence Erlbaum Associates.

Tesauro, G., Touretzky, D. S., and Leen, T. K. (eds.) (1995) Advances in Neural Information Processing Systems 7. Cambridge, MA: MIT Press.

Touretzky, D. S., Mozer, M. C., and Hasselmo, M. E. (eds.) (1996) Advances in Neural Information Processing Systems 8. Cambridge, MA: MIT Press.

Book Chapters and Encyclopedia Articles

Touretzky, D. S. and Hinton, G. E. (1987) Pattern matching and variable binding in a stochastic neural network. In Davis, L. D. (ed.) Genetic Algorithms and Simulated Annealing, Pitman Publishing, Ltd. Distributed in the United States by Morgan Kaufmann Publishers, Inc., San Mateo, CA.

Touretzky, D. S. (1987) Inheritance hierarchies. In Shapiro, S. C. (ed.), Encyclopedia of Artificial Intelligence, pp. 422-431. New York: John Wiley and Sons.

Touretzky, D. S. (1991) Connectionism and compositional semantics. In J. A. Barnden and J. B. Pollack (eds.) Advances in Connectionist and Neurally Oriented Computation, Volume 1: High-Level Connectionist Models, pp. 17-31. Norwood, NJ: Ablex.

Thomason, R. H., and Touretzky, D. S. (1991) Inheritance theory and networks with roles. In J. F. Sowa (ed), Principles of Semantic Networks: Explorations in the Representation of Knowledge, 231-266. San Mateo, CA: Morgan Kaufmann.

Wheeler, D. W., and Touretzky, D. S. (1993) A connectionist implementation of

cognitive phonology. In J. Goldsmith (ed.), The Last Phonological Rule. University of Chicago Press.

Touretzky, D. S. (1994) Continuity, polysemy, and representation: understanding the verb `cut'. In C. Fuchs and B. Victorri (eds.), Continuity in Linguistic Semantics, pp. 231-239. John Benjamins Publishing Company, Amsterdam.

Touretzky, D. S. (1995) Connectionist and symbolic representations. In M. A. Arbib (ed.), Handbook of Brain Theory and Neural Networks, pp. 243-247. MIT Press.

Redish, A. D., and Touretzky, D. S. (1997) Navigating with landmarks: computing goal locations from place codes. In K. Ikeuchi and M. Veloso (eds.), Symbolic Visual Learning. Oxford University Press.

Redish, A. D., and Touretzky, D. S. (1999) Separating hippocampal maps. In N. Burgess, K. Jeffrey, and J. O'Keefe (eds.), The Hippocampal and Parietal Foundations of Spatial Cognition, pp. 203-219. Oxford University Press.

Journal Articles

Touretzky, D. S. and Hinton, G. E. (1988) A distributed connectionist production system. Cognitive Science, vol. 12, number 3, pp. 423-466.

Rosenfeld, R., and Touretzky, D. S. (1988) Coarse-coded symbol memories and their properties. Complex Systems, vol. 2, number 4, pp. 463-484.

Horty, J. F., Thomason, R. H., and Touretzky, D. S. (1990) A skeptical theory of inheritance in nonmonotonic semantic nets. Artificial Intelligence 42(2-3):311-348, April 1990.

Touretzky, D. S. (1990) BoltzCONS: Dynamic symbol structures in a connectionist network. Artificial Intelligence vol. 46, pp. 5-46.

D. S., and Wheeler, D. W. (1991) Sequence manipulation using parallel mapping networks. Neural Computation 3(1):98-109.

Touretzky, D. S. (ed.) (1991) Editor's introduction to Machine Learning 7(2-3), special issue on ``Connectionist Approaches to Language Learning.''

Touretzky, D. S., and Lee, P. (1992) Visualizing evaluation in applicative languages. Communications of the ACM, 35(10):49-59.

Touretzky, D. S., Redish, A. D., and Wan, H. S. (1993) Neural representation of space using sinusoidal arrays. Neural Computation, 5(6):869-884.

Gupta, P., and Touretzky, D. S. (1994) Connectionist models and linguistic theory: Investigations of stress systems in language. Cognitive Science 18(1), pp. 1-50. January, 1994.

Touretzky, D. S., and Pomerleau, D. A. (1994) Reconstructing physical symbol systems. Cognitive Science 18(2), pp. 345-353. April, 1994.

Redish, A. D., and Touretzky, D. S. (1994) The reaching task: Evidence for vector arithmetic in the motor system? Biological Cybernetics, 71(4), pp. 307-317.

Touretzky, D. S. and Redish, A. D. (1996) Theory of rodent navigation based on interacting representations of space. Hippocampus, 6(3):247-270.

Redish, A. D., Elga, A. N., and Touretzky, D. S. (1996) A coupled attractor model of the rodent head direction system. NETWORK, 7(4):671-685.

Redish, A. D. and Touretzky, D. S. (1997) Cognitive maps beyond the hippocampus. Hippocampus, 7(1):15-35.

Wheeler, D. W., and Touretzky, D. S. (1997) A parallel licensing model of normal slips and phonemic paraphasias. Brain and Language, 59(1):147-201.

Touretzky, D. S. and Saksida, L. M. (1997) Operant conditioning in Skinnerbots. Adaptive Behavior, 5(3/4):219-247.

Redish, A. D., and Touretzky, D. S. (1998) The role of the hippocampus in solving the Morris water maze. Neural Computation 10(1):73-111.

Saksida, L. M., Raymond, S. M., and Touretzky, D. S. (1998) Shaping robot behavior using principles from instrumental conditioning. Robotics and Autonomous Systems, 22(3/4):231-249.

Goodridge, J. P., Redish, A. D., and Touretzky, D. S. (1999) A model of the rodent head direction system that accounts for unique properties of anterior thalamic head direction cells. Neurocomputing, 26-27:705-711.

Fuhs, M. C., and Touretzky, D. S. (in press) Synaptic learning models of map separation in the hippocampus. Neurocomputing, in press.

Daw, N. D., and Touretzky, D. S. (in press) Behavioral considerations suggest an average reward TD model of the dopamine system. Neurocomputing, in press.

Goodridge, J. P., and Touretzky, D. S. (in press) Modeling attractor

deformation in the rodent head direction system. Journal of Neurophysiology, to appear.

Refereed Papers

Fahlman, S. E., Touretzky, D. S., and van Roggen, W. (1981) Cancellation in a parallel semantic network. Proceedings of IJCAI-81, Vancouver, British Columbia, pp. 257-263.

Touretzky, D. S. (1983) A comparison of reduction in APL with polyarity in Lisp. Proceedings of APL83, Washington, DC, pp. 259-263.

Touretzky, D. S. (1984) Implicit ordering of defaults in inheritance systems. Proceedings of AAAI-84, Austin, Texas, pp. 322-325. Reprinted in M. Ginsberg (ed.), Readings in Nonmonotonic Reasoning, Morgan Kauffman, 1987.

Touretzky, D. S. and Hinton, G. E. (1985) Symbols among the neurons: details of a connectionist inference architecture. Proceedings of IJCAI-85, Los Angeles, CA, pp. 238-243.

Touretzky, D. S. (1986) BoltzCONS: reconciling connectionism with the recursive nature of stacks and trees. Proceedings of the Eighth Annual Conference of the Cognitive Science Society, Amherst, MA, pp. 522-530. Also reprinted in P. Mehra and B. W. Wah (eds.), Artificial Neural Networks, IEEE Computer Society Press, 1992.

Touretzky, D. S. (1987) Representing conceptual structures in a neural network. Proceedings of the IEEE International Conference on Neural Networks, Volume II, pp. 279-286. San Diego, CA, June 1987.

Horty, J. F., Thomason, R. H., and Touretzky, D. S. (1987) A skeptical theory of inheritance in nonmonotonic semantic networks. Proceedings of AAAI-87, pp. 358-363. Seattle, WA, July, 1987.

Touretzky, D. S., and Geva. S. (1987) A distributed connectionist representation for concept structures. Proceedings of the Ninth Annual Conference of the Cognitive Science Society, Seattle, WA, July 1987, 155-164.

Touretzky, D. S., Horty, J. F., and Thomason, R. H. (1987) A clash of intuitions: the current state of nonmonotonic multiple inheritance systems. Proceedings of IJCAI-87, 476-482. Milan, Italy, August, 1987.

Thomason, R. H., Horty, J. F., and Touretzky, D. S. (1987) A calculus for inheritance in monotonic semantic nets. Proceedings of the Second International Symposium on Methodologies for Intelligent Systems, Z. Ras and M. Zemankova, eds., North-Holland, Amsterdam, pp. 280-287.

Gerstenfeld, A., Gosling, G., and Touretzky, D. (1987) An expert system for managing cooperating expert systems. Proceedings of the Second International Conference on the Applications of Artificial Intelligence in Engineering. Boston, MA.

Rosenfeld, R., and Touretzky, D. S. (1988) Scaling properties of coarse-coded symbol memories. In D. Z. Anderson (ed.), Neural Information Processing Systems. Collected papers of the 1987 IEEE Conference on Neural Information Processing Systems - Natural and Synthetic, pp. 652-661. New York: American Institute of Physics.

Pomerleau, D. A., Gusciora, G. L., Touretzky, D. S., and Kung, H. T. (1988) Simulating neural networks at Warp speed: How we got 17 million connections per second. Proceedings of the IEEE International Conference on Neural Networks, volume 2, pp. 143-150. San Diego, CA, July 1988.

Touretzky, D. S., and Thomason, R. H. (1988) Nonmonotonic inheritance and generic reflexives. Proceedings of AAAI-88. St. Paul, MN, August 1988.

Touretzky, D. S. (1989) Analyzing the energy landscapes of distributed winner-take-all networks. In Touretzky, D. S. (ed.), Advances in Neural Information Processing Systems 1. San Mateo, CA: Morgan Kaufmann.

Touretzky, D. S. (1989) Chunking in a connectionist network. Proceedings of the Eleventh Annual Conference of the Cognitive Science Society, pp. 1-8. Hillsdale, NJ: Erlbaum.

Touretzky, D. S. (1989) Toward a connectionist phonology: the ``many maps" approach to sequence manipulation. Proceedings of the Eleventh Annual Conference of the Cognitive Science Society, pp. 188-195. Hillsdale, NJ: Erlbaum.

Gusciora, G. L., Pomerleau, D. A., Touretzky, D. S., and Kung, H. T. (1990) Back propagation on Warp. In B. Wah, M. F. Tenorio, P. Mehra and J. A. B. Fortes (eds.), Artificial Neural Networks: Applications and Implementations. IEEE Computer Society Press.

Schreinemakers, J. F., and Touretzky, D. S. (1990) Interfacing a neural network with a rule-based system for diagnosing mastitis. Proceedings of the International Joint Conference on Neural Networks, volume II, pp.

487-490. January, 1990, Washington, DC.

Touretzky, D. S., and Wheeler, D. W. (1990) A computational basis for phonology. In D. S. Touretzky (ed.), Advances in Neural Information Processing Systems 2, pp. 372-379. San Mateo, CA: Morgan Kaufmann.

Touretzky, D. S., and Elvgren, G., III (1990) Rule representations in a connectionist chunker. In D. S. Touretzky (ed.), Advances in Neural Information Processing Systems 2, 431-438. San Mateo, CA: Morgan Kaufmann.

Touretzky, D. S., Elvgren, G., III, and Wheeler, D. W. (1990) Phonological rule induction: an architectural solution. Proceedings of the Twelfth Annual Conference of the Cognitive Science Society, pp. 348-355. Hillsdale, NJ: Erlbaum.

Touretzky, D. S., Thomason, R. H., and Horty, J. F. (1991) A skeptic's menagerie: conflictors, preemptors, reinstaters, and zombies in nonmonotonic inheritance. Proceedings of IJCAI-91, Sydney, Australia, pp. 478-483.

Touretzky, D. S., and Wheeler, D. W. (1991) Exploiting syllable structure in a connectionist phonology model. In R. P. Lippmann, J. Moody, and D. S. Touretzky (eds.), Advances in Neural Information Processing Systems 3, 612-618. San Mateo, CA: Morgan Kaufmann.

Gupta, P., and Touretzky, D. S. (1991) What a perceptron reveals about metrical phonology. Proceedings of the Thirteenth Annual Conference of the Cognitive Science Society, 334-339. Hillsdale, NJ: Erlbaum.

Wheeler, D. W., and Touretzky, D. S. (1992) From syllables to stress: a cognitively plausible model. In K. Deaton, M. Noske, and M. Ziolkowski (eds.), CLS 26-II: Papers from the Parasession on The Syllable in Phonetics and Phonology, 1990. Chicago Linguistic Society.

Gupta, P., and Touretzky, D. S. (1992) A connectionist learning approach to analyzing linguistic stress. In J. Moody, S. J. Hanson, and R. P. Lippmann (eds.), Advances in Neural Information Processing Systems 4. San Mateo, CA: Morgan Kaufmann.

Jain, A. N., Waibel, A., and Touretzky, D. S. (1992) PARSEC: A structured connectionist parsing system for spoken language. IEEE Proceedings of the 1992 International Conference on Acoustics, Speech, and Signal Processing.

Touretzky, D. S., and Wang, X. (1992) Energy minimization and directionality in phonological theories. Proceedings of the Fourteenth Annual Conference of the Cognitive Science Society, 248-252. Hillsdale, NJ: Erlbaum.

Pomerleau, D. A., and Touretzky, D. S. (1993) Understanding neural network internal representations through hidden unit sensitivity analysis. In C. E. Thorpe (ed.), Proceedings of the International Conference on Intelligent Autonomous Systems. IOS Publishers, Amsterdam.

Redish, A. D., Touretzky, D. S., and Wan, H. S. (1994) The sinusoidal array: a theory of representation in parietal cortex. In F. Eeckman (ed.), Proceedings of the 1993 conference on Computational Neuroscience, Washington, DC.

Wan, H. S., Touretzky, D. S., and Redish, A. D. (1994) Computing goal locations from place codes. Proceedings of the Sixteenth Annual Conference of the Cognitive Science Society, pp. 922-927. Atlanta, Georgia, August, 1994.

Romero, R., Berger, R. W., Thibadeau, R. H., and Touretzky, D. S. (1995) Neural networks for optical Chinese character recognition. Proceedings of the Fourth Annual Symposium on Document Analysis and Information Retrieval. University of Nevada, Las Vegas. April, 1995.

Thibadeau, R., Romero, R., and Touretzky, D. (1995) Feature Center: Getting the picture from documents and drawings. Proceedings of the International Workshop on Graphics Recognition, pp. 243-251. Penn State University, University Park, PA. August, 1995.

Redish, A. D., and Touretzky, D. S. (1996) Modeling interactions of the rat's place and head direction systems. In D. S. Touretzky, M. Mozer, and M. Hasselmo (eds.), Advances in Neural Information Processing Systems 8, pp. 61-67. Cambridge, MA: MIT Press.

Touretzky, D. S. and Saksida, L. M. (1996) Skinnerbots. In P. Maes, M. Mataric, J.-A. Meyer, J. Pollack, and S. W. Wilson (eds.), From Animals to Animats 4: Proceedings of the Fourth International Conference on Simulation of Adaptive Behavior, pp. 285-294. Cambridge, MA: MIT Press.

Elga, A. N., Redish, A. D., and Touretzky, D. S. (1997) A computational model of the rodent head direction system. In J. Bower (Ed.), Computational Neuroscience: Trends in Research, 1997, pp. 623-629. New York: Plenum Publishing.

Redish, A. D., and Touretzky, D. S. (1998) The role of the hippocampus in the Morris water maze. In J. Bower (Ed.), Computational Neuroscience: Trends in Research, 1998, pp. 101-106. New York: Plenum Publishing.

Fuhs, M. C., Redish, A. D., and Touretzky, D. S. (1998) A visually driven

hippocampal place cell model. In J. Bower (Ed.), Computational Neuroscience: Trends in Research, 1998, pp. 379-384. New York: Plenum Publishing.

Invited or Unrefereed Papers

Touretzky, D. S. (1985) Inheritable relations: a logical extension to hierarchical inheritance. Proceedings of the CSCSI/SCEIO Workshop on Theoretical Approaches to Natural Language Understanding, Halifax, Nova Scotia, pp. 55-60.

Touretzky, D. S. (1986) Representing and transforming recursive objects in a neural network, or ``Trees do grow on Boltzmann machines." Invited paper, Proceedings of the 1986 IEEE International Conference on Systems, Man, and Cybernetics, Atlanta, GA, pp. 12-16.

Touretzky, D. S. and Derthick, M. A. (1987) Symbol structures in connectionist networks: five properties and two architectures. Invited paper, Digest of papers: COMPCON Spring 87, Thirty-Second IEEE Computer Society International Conference, February 23-27, Cathedral Hill Hotel, San Francisco, pp. 30-34.

Touretzky, D. S. (1987) Issues in symbol processing. Invited paper, Proceedings of the 1987 IEEE International Conference on Systems, Man, and Cybernetics, volume 2, pp. 781-785. Alexandria, VA, October 1987.

Touretzky, D. S. (1988) Beyond associative memory: connectionists must search for other cognitive primitives. Invited paper presented at the AAAI Spring Symposium, ``Parallel Models of Intelligence: How Can Slow Components Think So Fast?" March 22-24, 1988, Stanford, CA. Available from the CMU Psychology department as technical report AIP-34.

Touretzky, D. S. (1988) ``How Lisp Has Changed." Invited article, BYTE 13(2), pp. 229-234.

Touretzky, D. S. (1988) Connectionist PP attachment. In Touretzky, D., Hinton, G., and Sejnowski, T. (Eds.), Proceedings of the 1988 Connectionist Models Summer School, pp. 325-332. San Mateo, CA: Morgan Kaufmann.

Rosenfeld, R., and Touretzky, D. S. (1988) A survey of coarse-coded symbol memories. In Touretzky, D., Hinton, G., and Sejnowski, T. (Eds.), Proceedings of the 1988 Connectionist Models Summer School, pp. 256-264. San Mateo, CA: Morgan Kaufmann.

Touretzky, D. S., and Pomerleau, D. A. (1989) ``What's Hidden in the Hidden Layers?'' Invited article, BYTE 14(8), pp. 227-233. Reprinted in Australian Personal Computing.

Touretzky, D. S., and Wheeler, D. W. (1990) Rationale for a ``many maps'' phonology machine. Invited paper. In R. Trappl (ed.), Cybernetics and Systems '90: Proceedings of the Tenth European Meeting on Cybernetics and Systems Research, pp. 929-936. Singapore: World Scientific Publishing.

Touretzky, D. S., and Wheeler, D. W. (1990) Two derivations suffice: the role of syllabification in cognitive phonology. In C. Tenny (ed.), The MIT Parsing Volume, 1989-1990, pp. 21-35. MIT Center for Cognitive Science, Parsing Project Working Papers 3.

Touretzky, D. S., and Thomason, R. H. (1990) An inference algorithm for networks that mix strict and defeasible inheritance. Invited paper. In Z. W. Ras, M. Zemankova, and M. L. Emrich (eds.), Methodologies for Intelligent Systems, 5, pp. 212-225. Amsterdam: North-Holland. Proceedings of the Fifth International Symposium on Methodologies for Intelligent Systems, October 25-27, Knoxville, TN.

Touretzky, D. S., and Wheeler, D. W. (1990) Phonology as a window on symbol processing: theoretical and computational paradigms. Invited paper. In Z. W. Ras, M. Zemankova, and M. L. Emrich (eds.), Methodologies for Intelligent Systems, 5, pp. 446-455. Amsterdam: North-Holland. Proceedings of the Fifth International Symposium on Methodologies for Intelligent Systems, October 25-27, Knoxville, TN.

Touretzky, D. S. (1990) Parallel mapping circuitry in a phonological model. In D. S. Touretzky, J. L. Elman, T. J. Sejnowski, and G. E. Hinton (eds.), Proceedings of the 1990 Connectionist Models Summer School, pp. 220-227. San Mateo, CA: Morgan Kaufmann.

Touretzky, D. S. (1993) The hearts of symbols: Why symbol grounding is irrelevant. Invited symposium contribution. Proceedings of the Fifteenth Annual Conference of the Cognitive Science Society, pp. 165-168. June 18-21, 1993, Boulder, CO.

Wan, H. S., Touretzky, D. S., and Redish, A. D. (1994) Towards a computational theory of rat navigation. In Mozer, M. C., Smolensky, P., Touretzky, D. S., Elman, J. L., and Weigend, A. S. (eds.), Proceedings of the 1993 Connectionist Models Summer School, pp. 11-19. Hillsdale, NJ: Lawrence Erlbaum Associates.

Touretzky, D. S., Wan, H. S., and Redish, A. D. (1994) Neural

representations of space in rats and robots. In J. M. Zurada, R. J. Marks II, and C. J. Robinson (eds.), Computational Intelligence: Imitating Life, pp. 57-68. Piscataway, NJ: IEEE Press. (Invited paper presented at the symposium on Computational Intelligence: Imitating Life, held at the 1994 IEEE World Congress on Computational Intelligence. Orlando, Florida.)

Touretzky, D. S., and Redish, A. D. (1995) Landmark arrays and the hippocampal cognitive map. Invited paper. In L. Niklasson and M. Boden (eds.), Current Trends in Connectionism - Proceedings of the 1995 Swedish Conference on Connectionism, pp. 1-13. Hillsdale, NJ: Erlbaum.

Saksida, L.M. and Touretzky, D.S. (1997). Application of a model of instrumental conditioning to mobile robot control. In: Paul S. Schenker and Gerard T. McKee (Eds.) Sensor Fusion and Decentralized Control in Autonomous Robotic Systems. SPIE Vol. 3209. pp. 55-66.

Abstracts

Touretzky, D. S., Redish, A. D., Wan, H. S., and McNaughton, B. L. (1993) Sinusoidal arrays: A theory of vector representation in parietal and motor cortex. Soc. Neurosci. Abstracts, vol. 19, part 1, pp. 795.

Wan, H. S., Touretzky, D. S., and Redish, A. D. (1994) A rodent navigation model that combines place code, head direction, and path integration information. Soc. Neurosci. Abstracts, vol. 20, part 2, p. 1205.

Alyan, S. H., Touretzky, D. S., and Taube, J. S. (1995) The involvement of pasive path integration in learning the Morris water maze. Soc. Neurosci. Abstracts, vol. 21, p. 1939.

Redish, A. D. and Touretzky, D. S. (1995) Revisiting the Papez circuit: the role of hippocampus and its afferent and efferent connections in rodent navigation. Soc. Neurosci. Abstracts, vol. 21, p. 942.

Saksida, L. M., Redish, A. D., Milberg, C. R., Gaulin, S. J., and Touretzky, D. S. (1995) Landmark-based navigation in gerbils supports vector voting. Soc. Neurosci. Abstracts, vol. 21, p. 1939.

Touretzky, D. S., Gaulin, S. J. C., and Redish, A. D. (1996) Gerbils regularly return to their starting point when exploring a novel environment. Soc. Neurosci. Abstracts, vol. 22, p. 449.

Redish, A. D. and Touretzky, D. S. (1996) An anatomically grounded theory of rodent navigation. Soc. Neurosci. Abstracts, vol. 22, p. 678.

Fuhs, M. C., Redish, A. D., and Touretzky, D. S. (1997) Place cell-like location specific activity may be generated without complex landmark identification processes. Soc. Neurosci. Abstracts, 23:502.

Goodridge, J. P., Redish, A. D., Blair, H.T., Sharp, P.E., and Touretzky, D. S. (1997) Lateral mamillary input explains distortions in tuning curve shapes of anterior thalamic head direction cells. Soc. Neurosci. Abstracts, 23:503.

Redish, A. D., and Touretzky, D. S. (1997) Implications of attractor networks for cue conflict situations. Soc. Neurosci. Abstracts, 23:1601.

Fuhs, M. C., Goodridge, J. P., and Touretzky, D. S. (1998) Partial remappings of place fields suggest multiple types of local view information. Soc. Neurosci. Abstracts, 24:931.

Touretzky, D. S. (1998) Neuroscience concepts in a New Age religion: Scientology's model of the mind. Soc. Neurosci. Abstracts, 24:241.

Fuhs, M. C., and Touretzky, D. S. (1999) Synaptic learning rules that separate hippocampal maps. Soc. Neurosci. Abstracts, 25:1382.

Daw, N. D. and Touretzky, D. S. (1999) An average reward TD model of dopamine neuron function connects physiological and behavioral theories. Soc. Neurosci. Abstracts, 25:1385.

Technical Reports

Touretzky, D. S. (1974) CALL-OS Programmer's Guide. Academic Services Department, Educational Information Services, Inc. (now the New Jersey Educational Computer Network.)

Touretzky, D. S. (1975) OS/Hasp Job Control Language. Academic Services Department, New Jersey Educational Computer Network.

Touretzky, D. S. (1978) Learning From Examples in a Frame-Based System. Technical report, Department of Computer Science, Rutgers University.

Touretzky, D. S. (1983) A Summary of MacLisp Functions and Flags. Computer Science Department, Carnegie Mellon University. Fifth edition.

Touretzky, D. S. (1984) The Mathematics of Inheritance Systems. Computer Science Department, Carnegie Mellon University. Doctoral dissertation; technical report number CMU-CS-84-136.

Thomason, R. H., Horty, J. F., and Touretzky, D. S. (1986) A calculus for inheritance in monotonic semantic nets. Technical report CMU-CS-86-138. Computer Science Department, Carnegie Mellon University.

Rosenfeld, R., and Touretzky, D. S. (1987) Four capacity models for coarse-coded symbol memories. Technical report CMU-CS-87-182, Computer Science Department, Carnegie Mellon University.

Touretzky, D. S. (1989) Rules and maps in connectionist symbol processing. Technical report CMU-CS-89-158, School of Computer Science, Carnegie Mellon University.

Touretzky, D. S., Wheeler, D. W., and Elvgren, G., III (1990) Rules and maps II: Recent progress in connectionist symbol processing. Technical report CMU-CS-90-112, School of Computer Science, Carnegie Mellon University.

Touretzky, D. S., Wheeler, D. W., and Elvgren, G., III (1990) Rules and maps III: Further progress in connectionist phonology. Technical report CMU-CS-90-138, School of Computer Science, Carnegie Mellon University.

Thibadeau, R. H., Berger, R., Touretzky, D., and Lindsay, D. (1993) Video applications development platform. Technical report CMU-RI-TR-93-04, Robotics Institute, Carnegie Mellon University.

Review and Commentary

Touretzky, D. S. (1980) ``Artificial Intelligence" Letter to the editor, New England Journal of Medicine, vol. 302 number 26, June 26, 1980, p. 1491. Commentary on an essay by Lewis Thomas.

Touretzky, D. S. (1985) GCLisp, a Critique. The Artificial Intelligence Report, volume 2, number 3, March, 1985.

Rosenfeld, R., Touretzky, D. S., and the Boltzmann Group (1987) Connectionist models as neural abstractions. Commentary on the article ``How brains make chaos in order to make sense of the world," by Christine A. Skarda and Walter J. Freeman. Behavioral and Brain Sciences 10(2), pp. 181-182.

Touretzky, D. S. (1987) Connectionist models are also algorithmic. Invited commentary on the article ``Methodologies for studying human memory" by John R. Anderson. Behavioral and Brain Sciences 10(3), pp. 496-497.

Touretzky, D. S. (1988) On the proper treatment of thermostats. Invited commentary on the article ``On the proper treatment of connectionism'' by Paul Smolensky. Behavioral and Brain Sciences 11(1), pp. 55-56.

Touretzky, D. S. (1988) Review of ``Lisp Lore,'' second edition, by Hank Bromley and Richard Lamson. Lisp and Symbolic Computation 1(1), pp. 77-79.

Touretzky, D. S. (1990) Review of ``Common Lisp: the Reference,'' by Franz, Inc. Lisp and Symbolic Computation, 3(1), pp. 101-102.

Touretzky, D. S. (1993) Review of ``Neural Networks in Artificial Intelligence'' by Matthew Zeidenberg. Artificial Intelligence, 62(1), pp. 163-164.

Mitchell, M. (1993) Analogy-Making as Perception: A Computer Model. Cambridge, MA: MIT Press. (Foreword by D. S. Touretzky.)

Touretzky, D. S., and Fahlman, S. E. (1993) Should first order logic be neurally plausible? Invited commentary on the article ``From simple associations to systematic reasoning: A connectionist representation of rules, variables, and dynamic bindings using temporal synchrony'' by Lokendra Shastri and Venkat Ajjanagadde. Behavioral and Brain Sciences, 1993.

Patents

Thibadeau, R., Newcomer, J., and Touretzky, D. (1995) Television Receiver Location Identification. US patent number 5,432,542 issued July 11, 1995.

Thibadeau, R., Newcomer, J., and Touretzky, D. (1996) Method of Identifying Set-Top Receivers. US patent number 5,565,909 issued October 15, 1996.

Grants Awarded

Principal Investigator, National Science Foundation grant IST-8516330, ``Distributed Representations for Symbolic Data Structures.'' April 1 to December 31, 1986. $61,176.

Principal investigators Richmond H. Thomason and David S. Touretzky, National Science Foundation grant IST-8516313, ``Nonmonotonic Reasoning." April 1, 1986 through March 31, 1987. $60,868.

Co-investigator, Office of Naval Research contract N00014-86-K-0678, ``Learning, Teaching, and Discovery in AI and Psychology." This five-year contract began September 15, 1986, and jointly funded ten independent investigators at CMU and the University of Pittsbrugh. $3,932,501.

Principal investigators David S. Touretzky and Richmond H. Thomason, National Science Foundation grant IRI-8700705, ``Logical Foundations for Inheritance Theory and Knowledge Update." June 1, 1987 though May 31, 1989. $222,845.

Principal investigators Scott E. Fahlman and David S. Touretzky, National Science Foundation grant EET-8716324, ``Studies of Learning and Representation in Distributed Connectionist Networks." September 15, 1987 through February 28, 1991. $527,695.

Principal investigator for three grants of $10,000 each from the Air Force Office of Scientific Research, the American Association for Artificial Intelligence, and the Association for Computing Machinery's Special Interest Group on Artificial Intelligence, to support the 1988 Connectionist Models Summer School.

Principal investigator, Hughes Research Laboratories grant, ``Connectionist Linguistics Project." January - December, 1989. $35,000. Renewed through December 1990, for an additional $35,000, and again through December 1991 at $30,000.

Co-prinicipal investigator (with Robert H. Thibadeau), CSX Logistics Information Services, research contract for work on pattern recognition. April 1 through December 31, 1990. $334,000.

Principal investigators Alex Waibel, Tom Mitchell, and David S. Touretzky, Fujitsu Laboratories Ltd. research contract, ``Symbolic and Connectionist Learning for Robot Control." June, 1990 through May, 1993. $443,407.

Principal investigators David S. Touretzky, Richmond H. Thomason, and John F. Horty, National Science Foundation grant IRI-9003165, ``Inheritance Theory and Knowledge Bases." September 15, 1990 through February 28, 1994. $270,791.

Principal investigator (with co-investigators Deirdre Wheeler and Steven Small), McDonnell-Pew Foundation grant, ``Modeling Phonotactic Constraints

in Normal and Aphasic Speech." July 1, 1992 through June 30, 1994.
$60,000.

Principal investigators Robert H. Thibadeau and David S. Touretzky.
``Chinese Character Recognition Using Neural Networks." US Government.
March, 1994, ongoing. $618,832.

Principal investigators David S. Touretzky and Steven J. C. Gaulin. ``The
Cognitive Neuroscience of Rodent Navigation." Center for the Neural Basis
of Cognition seed money grant. October, 1994 through May, 1996. $40.095.

Principal investigator, National Science Foundation grant IRI-9530975, ``A
Computational Theory of Operant Conditioning with Application to Trainable
Robots." June, 1996 through November, 1999. $250,000.

Principal investigator, National Science Foundation grant IBN-9631336,
``Computational Modeling of the Rodent Head Direction System." August 15,
1996 through July 31, 1998. $100,000.

Principal investigators Walter Schneider, David Touretzky, G. Bard
Ermentrout, and Daniel Simons, National Science Foundation grant
DBI-9605167, ``Neural Basis of Cognition Undergraduate Summer Program".
January 1, 1997 through December 31, 1999. $153,746.

Principal investigators David S. Touretzky, Julie Fiez, Tai Sing Lee, James
L. McClelland, and William Skaggs. National Science Foundation grant
IRI-9720350, ``The Biological Basis of Incremental Learning." October 1,
1997 through September 30, 2000. $775,000.

Principal investigators David S. Touretzky and Walter Schneider. National
Science Foundation IGERT award 9987588, ``Cross-Disciplinary Training in the
Neural Basis of Cognition." May, 2000 through April, 2005. $1,838,752.

Principal investigator, National Science Foundation grant IIS-9978403,
``Memory-Based Operant Learning." December 1999 through November 2002.
$338,333.

Editorial Activities

Member of the editorial board of Cognitive Science since 1989. Ablex
Publishing Corp. Executive editor Martin Ringle.

Founding member of the editorial board, Higher-Order and Symbolic

Computation (originally called Lisp and Symbolic Computation: An International Journal.) Kluwer Academic Publishers. Chief editors are Carolyn Talcott and Olivier Danvy.

Founding member of the editorial board of Neural Computation, since 1989. The MIT Press. Chief editor is Terrence Sejnowski.

Founding member of the advisory editorial board, NETWORK. Institute of Physics/Blackwell Scientific Publications (England). Joined the executive board in January 1992; served until 1997.

Founding member of the advisory board, Neural Computing Surveys, since July 1996. An electronic journal published in Postscript and HTML forms.

Founding member of the editorial board, The Journal of Artificial Intelligence Research. Served through December 1995. Chief editor is Steve Minton.

Selected Other Professional Activities

Executive committee, Center for the Neural Basis of Cognition: a joint research center of Carnegie Mellon University and the University of Pittsburgh, January 1994 to present. Also, co-chair of the CNBC's Graduate Education Committee.

Program committee, SAB2000 (Sixth International Conference on the Simulation of Adaptive Behavior). September 11-15, 2000, Paris, France.

Conference co-chair, Eighth Annual Computational Neuroscience Meeting (CNS*99). July 18-22, 1999, Pittsburgh, Pennsylvania.

Board of directors, the Neural Information Processing Systems Foundation, 1995 to present. General chair, NIPS*95 (Neural Information Processing Systems) conference. Program chair, NIPS*94. Organizing and/or program committee, 1987-1990 and 1992-1993. Publications chair, 1988-1990; algorithms and architectures co-chair, 1992; tutorials chair, 1993.

Founding member, 1994, Neural Networks Technical Committee (chaired by Jacek Zurada), advisory committee to the IEEE Neural Networks Council.

Creator and maintainer since July 1986 of the CONNECTIONISTS mailing list, a worldwide electronic forum for neural network researchers to exchange ideas, drafts of papers, and abstracts of technical reports.

Professional memberships: Association for Computing Machinery, SIGART, the American Association for Artificial Intelligence, the Cognitive Science Society, the International Neural Network Society, and the Society for Neuroscience.